

that the Weather Bureau investigate the question why some kinds of trees are more frequently struck by lightning than others. He suggests that actual experiments with artificial lightning, such as that given by the apparatus constructed by Prof. John Trowbridge, at Harvard University, may be able to show the intrinsic differences in the effect of the discharge through different kinds of wood, and that the physicist, the Weather Bureau, the Division of Forestry, and the Division of Vegetable Pathology might combine in this study. On the other hand, Professor Trowbridge writes us that "the character of the wood, whether oak or pine, weighs but little in comparison with other physical conditions." The following paragraph quoted from Mr. McAdie's letter of February 19, 1898, will suggest lines of study to many voluntary observers:

I have the honor to invite attention to the need of an authoritative answer to the question "Why some trees are more frequently struck by lightning than others?" At first glance the subject may seem to be foreign to the work of the Weather Bureau; but investigation will show that some phases of the question are germane to the work of this Bureau and proper subjects for study.

Primarily it is a matter of saving human life; and in that direction the Weather Bureau has always put forward its best efforts. Many people, particularly farmers and those who work in the fields exposed to thunderstorms, will work until the storm is almost upon them, and then run to the nearest tree for shelter. If the tree is an oak and the charged thunder clouds are moving toward it, with high electrical potential, the person or persons under the tree are in the line of strain, and all unconsciously are contributing to the establishment of a path for the lightning discharge through themselves. Records show how frequently death results, and how dangerous it is to stand under certain trees during thunderstorms. On the other hand, if it had happened to be a beech tree, there is some reason to believe that it will afford safety as well as shelter, though the reason why is not at present known. It is known that the oak is relatively most frequently and the beech least frequently struck. If the relative frequency of the beech is represented by 1, that for the pine is 15, trees collectively about 40, and oaks, 54. Trees struck are not necessarily the highest and most prominent. Oak trees have been struck twice in the same place on successive days. Trees have been struck before rain began and split; and trees have been struck during rain and only scorched. It is plain then that before any statement is made as to the danger of standing under certain kinds of trees during thunderstorms, the more general questions of the effects of lightning upon trees should be gone into. Such a study would be best undertaken by coöperated effort of statistician, physicist, and vegetable pathologist.

The Editor hopes that those familiar with the forests in their respective neighborhoods will contribute a few words as to their own local experience in the matter of the relative frequency of lightning strokes on different kinds of trees. Of course, their statements must be accompanied by a careful estimate of the relative number or frequency of the trees themselves. Thus, if in a forest where oaks and pines are fairly well distributed, the pines are twice as numerous as the oaks, and it has been found by actual count that during any given number of years, 10 oaks and 5 pines have been struck, it will, of course, follow that the relative frequency of the lightning strokes is as 4 to the oak and 1 to the pine.

In this connection the following remarks by Mr. Austin Cary, of East Machias, Me., have just been received. Mr. Cary has had wide experience in the forests of New England, and says:

The only trees I ever noted struck by lightning were large spruce and pine and, sometimes, stubs left after a fire in burnt land. My idea was that the tall, prominent trees attracted the strokes. Pines usually stand high above the surrounding timber. I certainly think such trees are particularly liable to be struck. I have also frequently seen large spruce hit by lightning. Sometimes a narrow cut is made down the bark; sometimes big, long splinters are split out and thrown around. I do not remember ever to have seen a hard-wood tree marked by lightning. The flat crown of these trees and the comparatively even cover which a hard-wood forest presents may explain this. I learn, however, that elms are likely to be struck. This may be because they, as shade trees, stand apart.

#### TIN ROOFS AS LIGHTNING CONDUCTORS.

Under date of May 28, 1887, the journal of the Weather Bureau station at Little Rock, Ark., which was at that time kept by Mr. W. U. Simons, says:

A thundershower; thunder very heavy, and brilliant, zigzag and ball lightning, at times very near; night cloudy. Rossner Block struck by lightning.

In a recent letter, dated July 13, at Key West, Mr. Simons gives a fuller account of this event, as follows, having especially in view the efficacy of a tin roof as a means of protection against damage by lightning:

Mr. Fred. Rossner had recently erected a large three or four story brick building, with a tin roof, distant from the Weather Bureau office about 300 feet. During a heavy rain and thunderstorm a flash of lightning struck the roof of the Rossner building. I was standing at the office window, and, although for an instant the flash blinded me, I saw it apparently cover the entire roof with a thin blue flame, resembling alcohol burning on a flat surface. Almost immediately it appeared to flow toward the southeast corner of the building and disappeared. I learned afterward that it had passed down the waterspout at that corner of the house, and where it went to earth there was a hole in the ground about the size of an ordinary water bucket, but not a joint of either the tin roof or the waterspout had been melted. My idea of it at the time was that the rain on the roof formed such a complete covering that the electricity diffused itself through that, then followed the waterspout to the ground, using the water as a conductor.

From the preceding description it would seem that in this case the building was saved from injury, not so much by the tin roof and tin water spout as by the layer of rain water that fortunately covered the roof and filled the spout at that time. Had the roof and spout been dry, it might well have happened that every soldered joint had been melted and many a square of tin burned to destruction; under such circumstances, the building itself would have been in great danger.

#### RAIN GUSHES AND THUNDERSTORMS.

The article in the MONTHLY WEATHER REVIEW for July, 1897, page 303, has called forth several letters during the last year from those interested in the subject from which we quote as follows:

Prof. Milton Updegraff, Director of the Astronomical Observatory of the State University at Columbia, Mo., says:

I remember seeing somewhere the following plausible explanation of the connection between rain gushes and lightning. The large drops of rain, being formed from smaller drops of water, must be charged on their surfaces to a higher electrical potential than the smaller drops of which they are formed, for obvious geometrical reasons. Thus, a sudden and simultaneous condensation in a cloud would produce a higher electrical potential which might cause a flash of lightning which would be seen shortly before the rain drops reach the earth.

Mr. H. D. Govey, of North Lewisburg, Ohio, remarks:

It is a general expression "that a harder rain, in general, immediately succeeds a flash of lightning or heavy thunder." I have noticed this many times in the last sixty years. If the hard thunder was about overhead then comes the harder rain, but if far distant the harder downpour for a minute or two may not come. There may be electrical attraction or repulsion between the particles of moisture that on a stroke of lightning lets them unite and fall in large drops of rain, but if no lightning so that their electricity may pass off they repel each other and not much rain falls from that cloud. In hot weather, almost invariably, if a heavy cloud arises in the west or in a westerly direction and is not accompanied by thunder then generally very little rain falls from it, but if accompanied by heavy thunder there is a heavy rainfall as long as the thunder lasts, when that ceases the rain also stops. Rain invariably follows thunder [or the thunder (and lightning) follows the rain]. Therefore, to have a "rain gush" the thunder must be overhead (in the zenith) or a little west of it. When a nimbus cloud arises in the west (in hot weather) not much rain may be expected to fall from it unless accompanied by thunder and lightning. Can not electrical attraction and electrical repulsion account for a part, at least, of the phenomena?

Prof. H. A. Hazen, of the United States Weather Bureau at Washington, says:

On Saturday, June 25, 1898, while standing in a sheltered place in this city I had an excellent opportunity for noting thunderstorm phe-